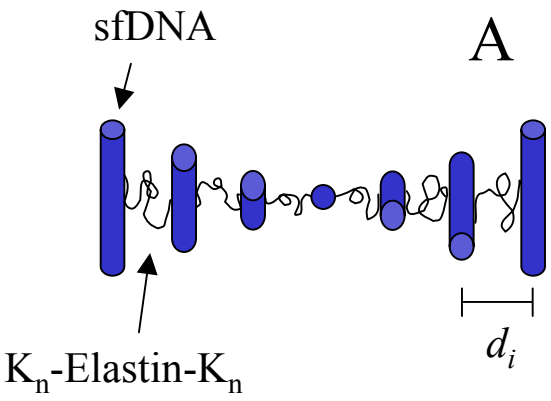
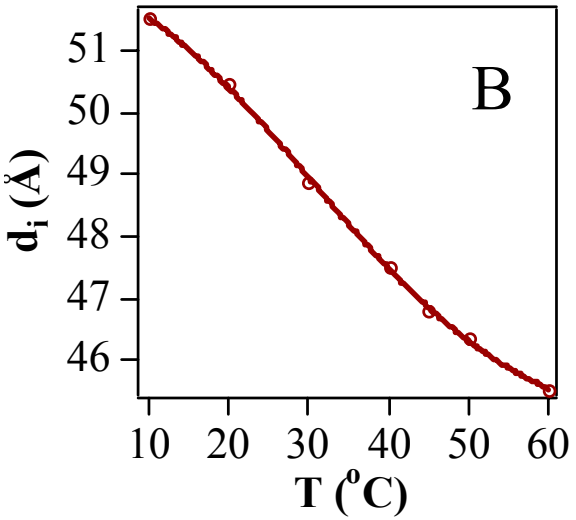
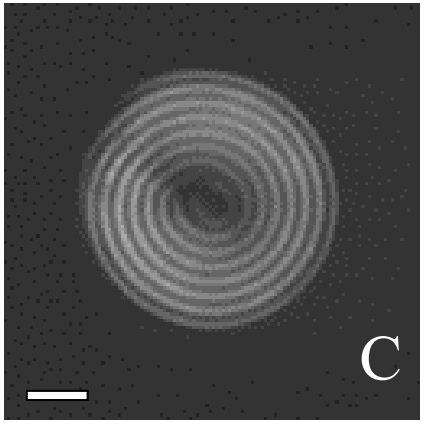
Chiral Biopolymer Liquid Crystals

Helmut H. Strey, UMass Amherst, DMR-9984427

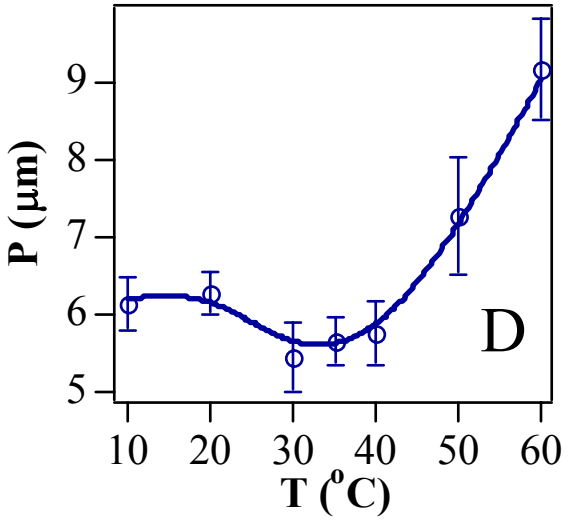
This project investigates whether chiral biopolymer liquid crystals can be utilized for biosensor application. Here we show a proof of principle using an artificial Elastin peptide that can link between short DNA fragements (blue rods) comprising a cholesteric liquid crystal (Fig.A). Elastin is a polypeptide used as arterial wall material and is known to contract when the temperature is raised above 30 degrees Celsius. By coupling elastin to DNA we turned the DNA cholesteric liquid crystal into a temperature sensor. Both the density (spacing between DNAs, Fig. B) of the liquid crystal as well as the cholesteric pitch as illustrated in Fig.C,D change with temperature.







Polarization micrograph of a DNA cholesteric.



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Education:

6 undergrads (3f,3m)
2 grad students (2m)
1 post-docs (f)

I developed and refined a biopolymer lecture which covers intermolecular interactions between biological molecules (electrostatic, dispersion, steric, fluctuations, hydrophobic) as well as mechanisms and thermodynamic of self-assembled systems (viruses, membranes, chromatin, proteins) as well as single-molecule experiments.

Outreach and education activities:
In 1999 and 2000 I introduced polymers to children (Kindergarden, Medical Center Nursery School in Washinton Heights, New York City, NY) in a playful way by performing simple experiments with slime.
Since 1999 I established a biophysics REU exchange program with Smith College. In 2001 gave a biophysics lecture at Mt. Holyoke College "How to squeeze DNA through a hole".

Group photo of the 2002 REU students at the Polymer Science Department